Aircraft Flight Envelope Identification through On-Board Model Based Estimation, Phase I

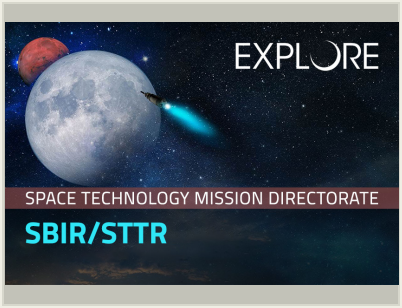
Completed Technology Project (2009 - 2009)

Project Introduction

To improve aviation safety with anticipated growth in capacity, it is necessary to develop flight control technologies that enable safe operations as anomalous conditions occur. These developments are particularly important to reduce fatal loss of control accidents due to aircraft degradation and abrupt aerodynamic changes including upsets. It is necessary to develop methods to identify and characterize anomalies in flight, as well as to estimate the impacts on the flight envelope and the ability to effect control forces for recovery and/or flight planning to achieve safe landing. An approach to identify anomalies including aerodynamic upsets based on model-based fault detection methods will be combined with physics-based models to assess the impact on the aircraft flight envelope and controllability. These tools will permit off-line analysis and will facilitate the development of on-board guidance and control algorithms to support NASA goals for greater aircraft resiliency during adverse flight conditions. In Phase I, development and demonstration of a generalized system architecture to identify and assess the effects of aircraft anomalies will be performed, which builds upon previous work toward model-based aircraft upset detection. Phase I demonstrations will include simulation evaluation for a generic transport aircraft and test demonstration for a small unmanned aircraft.

Anticipated Benefits

Potential NASA Commercial Applications: In addition to improving safety of existing and future commercial aircraft systems, the results of this research and development will also benefit general aviation, in particular for aircraft with modern avionics systems. Detection and assessment of a subset of aircraft anomalies and upset conditions may potentially be performed using reduced, low-cost sensor packages. This spin-off technology application may be incorporated into a retrofittable (portable) system, thus permitting development of a stand-alone avionics package that may have broad application beneficial to all general aviation aircraft.



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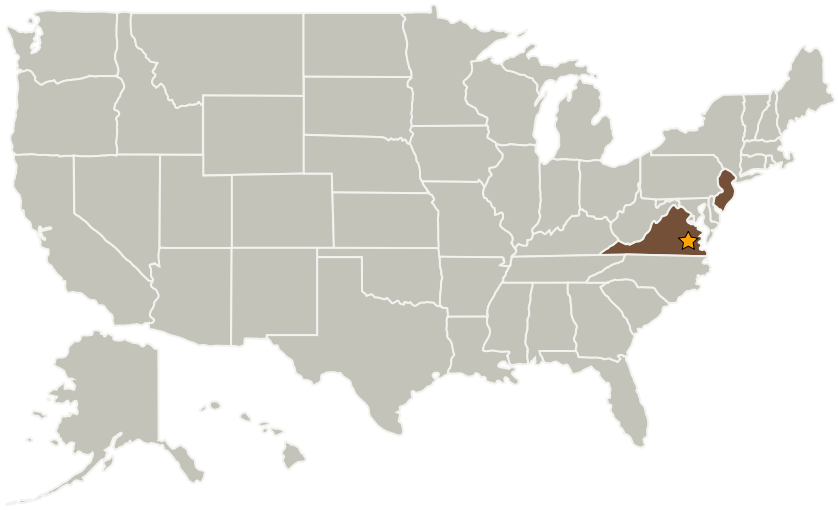
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Continuum Dynamics, Inc.	Supporting Organization	Industry	Ewing, New Jersey

Primary U.S. Work Locations	
New Jersey	Virginia

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Aircraft Flight Envelope Identification through On-Board Model Based Estimation, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

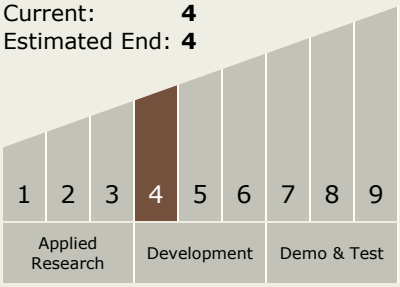
Carlos Torrez

Principal Investigator:

Jefrfrey D Keller

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.6 Fault Response